ADVANCED MATERIALS

Supporting Information

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Bioinspired Optoelectronic Nose with Nanostructured Wavelength-Scalable Hollow-Core Infrared Fibers

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Bio-inspired optoelectronic nose with nanostructured wavelength scalable hollow-core infrared fibers

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Supporting Information

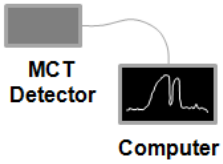
Experimental

Wavelength scalable hollow core infrared transmitting fiber production:

Fibers production involves chalcogenide glass synthesis, preform fabrication and fiber drawing. Chalcogenide glasses are synthesized from ultrapure elements using the melt quenching technique[1,2]. Macroscopic preforms are obtained by rolling high temperature engineering polymer films after thermally evaporating the synthesized high index infrared glasses on large area polymers to obtain the quarter wavestack structures[3]. Fibers with varying transmission bands are obtained by thermally drawing the macroscopic preforms to intended diameters.

Intensity Ratio (I/I_0) measurements:

Vapour phase analyte were introduced into the fibers by passing carrier nitrogen gas at approximately 0.2 l/min from a 100 ml flask filled with approximately 5 ml analyte. FTIR blackbody source and an MCT detector was used for the transmission quenching measurements. (**Scheme S1**). Fiber transmission before and after analyte insertion was recorded after 2 seconds exposition to calculate the intensity ratio (I/I_0). Low concentration THF measurements were carried out by diluting analyte in methanol, assuming solution ideality[4]



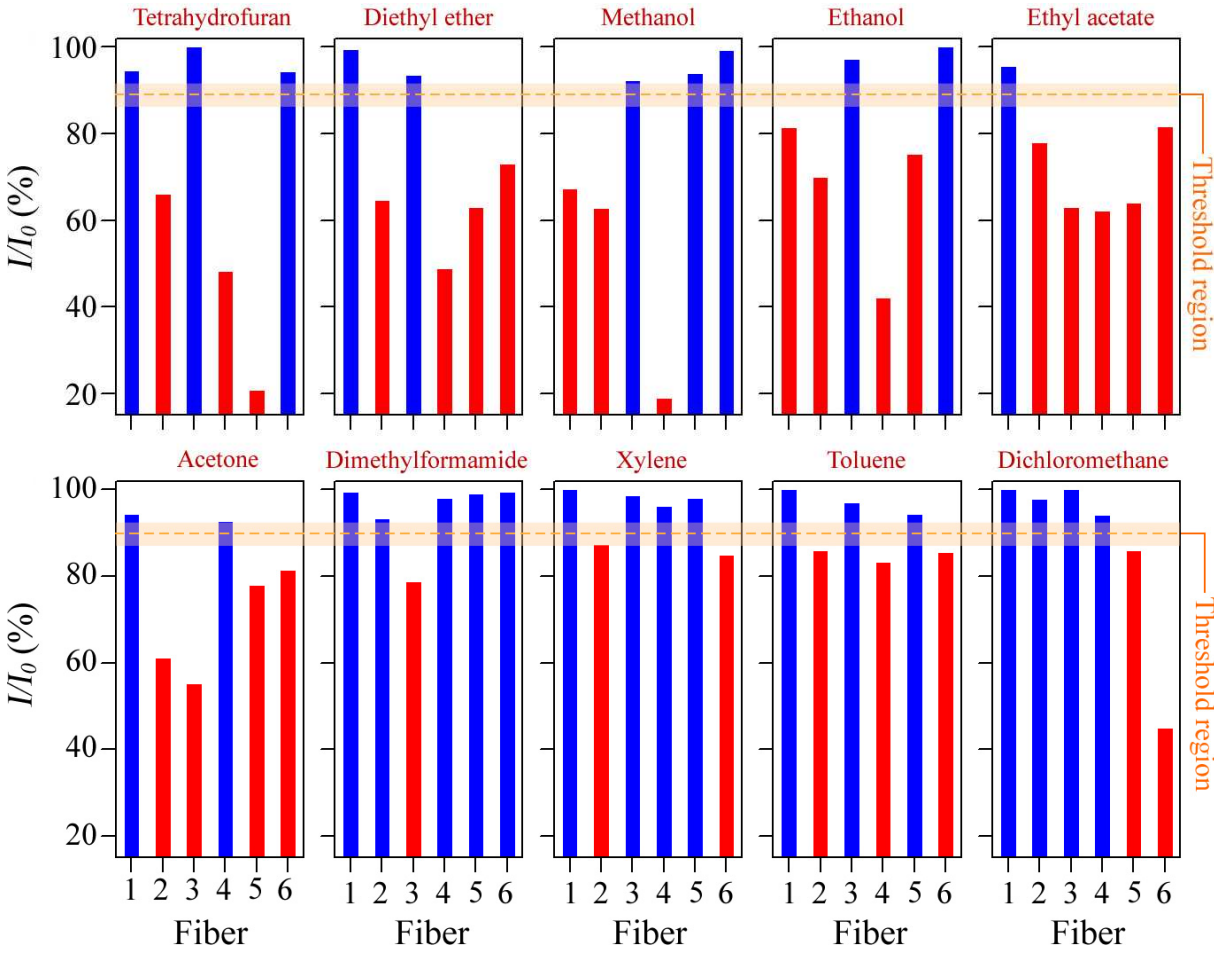
:onic band gap infrared

Measured Results

In **Table S1**, we recorded fiber responses, intensity ratio (I/I_0), for each analyte as a binary code. In the binary representation, the first three digits indicate the general group of the analyte such as alcohols, ethers, aromatics, etc., and the next three digits specify the chemicals in each group. For example, for alcohols the first three digits are '110', and the next three digits differentiate ethanol '110' from methanol '100'. In our design, however, ethers and aromatics have the same type information (first three digits '010') because there is no fiber presents matching their functional group absorption bands, notwithstanding the fact that the analytes are still distinguishable. In principle it is possible to represent type information for more chemicals by simply increasing the fiber number in the array. Furthermore, the fiber responses can easily be distinguished by converting the binary code to an equivalent decimal number (**Table S1**). From the table, allowed threshold region is determined to be 87.4-92.3%. A threshold value of 90% can successfully differentiate all chemicals in the set.

Supporting Table 1. Chemical identification table. Alcohols, ethers, carbonyl containing molecules, aromatics and other chemicals are identified and grouped using fiber array binary coding. The intensity ratios obtained for all chemicals, corresponding binary codes and decimal equivalents are shown, indicating unique codes for each analyte.

Chemicals		Fiber 1	Fiber 2	Fiber 3	Fiber 4	Fiber 5	Fiber 6	Binary Code	Decimal Code
Ethers	Tetrahydrofuran	94.5	66.0	100.0	48.2	20.7	94.4	010 110	22
	Diethyl ether	99.6	64.6	93.6	48.8	63.0	73.0	010 111	23
Alcohols	Methanol (MeOH)	67.2	62.8	92.3	18.9	94.0	99.2	110 100	52
	Ethanol	81.4	70.0	97.3	42.0	75.3	100	110 110	54
Carbonyl containing	Ethyl acetate	95.6	77.9	62.9	62.1	64.0	81.6	011 111	31
	Acetone	94.4	61.1	55.2	92.8	77.9	81.5	011 011	27
	Dimethylformamide (DMF)	99.5	93.3	78.7	98.1	99.0	99.5	001 000	8
Aromatics	Xylene	100.0	87.4	98.6	96.3	98	85	010 001	17
	Toluene	100.0	86	97.1	83.3	94.3	85.6	010 101	21
Other	Dichloromethane (DCM)	100.0	97.9	100	94.2	85.9	44.9	000 011	3



Supporting Figure 1. Fiber array response vectors are shown as bar charts for each analyte. The allowed threshold region to differentiate all ten chemicals is indicated.

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